



AT&T and California Institute of the Arts
proudly present

**TWO EVENINGS OF MUSIC
CONTROLLED BY BRAIN WAVES**

May 8
LOS ANGELES COUNTY MUSEUM OF ART

May 12
produced in collaboration with
ELECTRONIC CAFE INTERNATIONAL, Santa Monica
ECI at THE KITCHEN, New York
STUDIO X, Santa Fe

Monday May 8, 1995

Bing Auditorium, Los Angeles County Museum of Art

Music For Piano With One Or More Snare Drums
Vicki Ray, piano

Alvin Lucier

Fideliotrio

Laura Kuennen-Poper, viola
Erika Duke-Kirkpatrick, cello
Vicki Ray, piano

Alvin Lucier

-----INTERMISSION-----

On Being Invisible II

(Hypatia Speaks to Jefferson in a Dream) David Rosenboom

Sara Roberts, brainwaves (Hypatia)
Susan Allen, electric harp (Double1)
Daniel Rothman, brainwaves (Jefferson)
Leo Smith, trumpet (Double 2)
Nicholas England, narrator
David Rosenboom & Kent Clelland, computer media

A conversation with the composer

David Rosenboom

A reception will follow the concert.

Friday May 12, 1995

Electronic Cafe International

Introduction

Eric Martin in Santa Monica
John Hobbs in New York
David Brownlow in Santa Fe

Music for Solo Performer

Alvin Lucier, brain waves
technical assistants: Matt Rogalsky,
Gerald Hartnett in New York;
Robert O'Neill in Santa Monica

Alvin Lucier

Music For Piano With

One Or More Snare Drums
Gregg Koyle, piano in Santa Fe

Alvin Lucier

A conversation with Alvin Lucier

Introduction to works in progress

Morton Subotnick &
Mark Coniglio

Angel Concerto

Morton Subotnick

Binary Aria, an excerpt from
The Electronic Disturbance

performed by Troika Ranch
Jacqueline Bobak, voice
dancers in New York: Lana Halvorsen,
Rose Marie Hegenbart,
Artemis Preeshi, Dawn Stoppiello
sampled voice: Ilaan Egeland

Mark Coniglio &
Dawn Stoppiello

Reception in Three Cities

Yamaha MX100 II Disklavier in Santa Fe provided by the Yamaha Corporation Keyboard Division, and Music World of Albuquerque.
Special Thanks: Joel Kabakov and Don Johnson.

Music For Piano With One Or More Snare Drums [Alvin Lucier] is one of a series of works I have written for piano with resonant objects. In *Music For Piano With Amplified Sonorous Vessels*, microphones, inserted in small containers placed inside the piano pick up resonances specific to the physical dimensions of the containers and in *Nothing Is Real*, fragments of a Beatles song are heard flowing from a teapot. In this work, tones from a piano sympathetically resonate snare drums, positioned throughout the space.

The pianist plays a series of notated pitches in chronological order, repeating them in various overlapping patterns. As she does so, the drums respond depending on the pitch of the piano tones, the resonant regions of the drums and their geographical locations in space.

Fideliotrio [Alvin Lucier] is the latest in a series of works I have made which explore the physical interaction of the sound waves of musical instruments. As the waves flow out of the instruments they collide in space, creating audible beats--bumps of sound produced as the wavefronts coincide--at speeds determined by the distance between the pitches of the instruments. The farther apart, the faster the beating; at unison, no beating occurs. Furthermore, under certain circumstances the beats may be heard to spin around the room.

In previous pieces, including *Crossings* for small orchestra, *In Memoriam Jon Higgins* for solo clarinet, and *Kettles* for five timpani, I have combined the instrumental sounds with electronically generated sine tones, whose wave forms are simple enough to reveal these acoustic phenomena to their best advantage. In *Fideliotrio*, however, I have relied solely on acoustic instruments, asking of the string players an extraordinarily high degree of bow and pitch control and of the pianist, very subtle variations of timing and attack.

Throughout the performance the two string players slowly sweep up and down a semitone above and below a center tone. As they do so the pianist repeats the tone at irregular intervals, varying only the loudness of her attacks. As the sounds of the two bowed strings interfere with the three hammered strings of the single piano tone, slight variations in timbre and spatial location occur.

Fideliotrio was commissioned by The Fidelio Trio: Sanda Schuldmann, piano; Harry Clark, cello; and Lois Martin, viola. It was first performed by them on January 3, 1988, at the Old State House, Hartford, Connecticut, as part of the Chamber Music Plus new year's program.

Music for Solo Performer [Alvin Lucier], for enormously amplified brain waves and percussion, was the first work in history (1965) to use brain waves for musical purposes. During a performance, a performer sits with electrodes affixed to his or her scalp. The electrodes are routed through a small amplifier and

several audio amplifiers and loudspeakers. The speakers are directly coupled to percussion instruments, including drums, gongs, cymbals and found objects. An assistant is often used to channel the amplified alpha waves to the various percussion instruments deployed throughout the space.

The idea for *Music for Solo Performer* came out of a series of conversations I had in 1964 with physicist Edmond Dewan of the Air Force Cambridge Research Laboratory in Bedford, Massachusetts. At that time, Dewan was engaged in brainwave research particularly as it pertained to flying: it was believed that certain periodic visual rhythms of slow propeller speeds were locking onto corresponding brainwave frequencies of aircraft pilots, causing dizziness, blackouts, and epileptic fits. Dewan, an accomplished amateur organist, was eager to share his ideas and equipment with any composer interested in exploring this hitherto uncharted region. Inspired by the imagery and technology of electroencephalography, I immediately set to work to discover all I could about alpha.

Working long hours alone in the Brandeis University Electronic Music Studio with Dewan's equipment (two Tektronix Type 122 preamplifiers in series, one Model 330M Kronhite Bandpass Filter, which had been set for a range of from 9 to 15 Hz, one integrating threshold switch, electrodes, appropriate connectors, etc.) plus the studio's conventional equipment, I learned to produce alpha fairly consistently. I found that success could be attained by setting the gain on the audio amplifier to a point just below oscillation so that even a relatively weak alpha signal would come through. Often, I could produce alpha only in short bursts; it took precisely the right physical and psychological conditions to sustain it in longer phrases. I did not attempt any experiments in bio-feedback as such but was aware of the reinforcement of my own alpha-producing ability while monitoring in real time the sounds that came out of the studio loudspeakers. I observed that over long periods of time, for example while recording alpha for storage material for use in performances, or when tired, relaxed or slightly bored, the alpha would tend to drift somewhat downward and settle.

From the beginning, I was determined to make a live performance work despite the delicate uncertainty of the equipment, difficult to handle even under controlled laboratory conditions. I realized the value of the EEG situation as a theatre element and knew from experience that live sounds are more interesting than taped ones. I was also touched by the image of the immobile if not paralyzed human being who, by merely changing states of visual attention, can activate a large configuration of communication equipment with what appears to be power from a spiritual realm. I found the alpha's quiet thunder extremely beautiful and, instead of spoiling it by processing, chose to use it as an active force in the same way one uses the power of a river.

I used the alpha to resonate a large battery of percussion instruments including cymbals, gongs, bass drums, timpani, and other resonant found objects. In most cases, it was necessary physically to couple the loudspeaker to the instrument, although in the case of highly resonant bass drums and timpani, the loudspeaker

could be an inch or so away. Placing loudspeakers in trashcans or cardboard boxes worked extremely well as did using cheap small speakers face down on snare drums or taped against windows. I learned that by varying both short bursts and longer sustained phrases of alpha plus making musical decisions as to the placement of loudspeakers, choice of resonant instruments or objects, volume control, channeling and mixing, I was able to get a wide variety of sonorities as well as retain the natural physical quality that seemed asked for by the sound source itself.

In conjunction with the threshold switch, I used the alpha as a control signal to operate a stereo tape recorder upon which was stored transposed versions of prerecorded alpha accelerated up to five times. These higher phantoms relieved the sameness of the low-frequency originals and were used both by themselves and to impart contrasting resonances to whatever instruments they were coupled to. My original intention was to develop the idea of control to include more sophisticated systems of lights, alarms, television sets, radios, whole environments.

Although an assistant is usually needed to operate the preamplifier controls, I did perform *Music for Solo Performer* by myself on the 'Visions of the Present' festival in Stockholm in 1966. I succeeded in producing alpha by letting my hands operate the amplifier controls as randomly as possible to avoid visualization caused by decision-making with reference to channeling and placement of loudspeakers. I have always wanted to have a situation in which the alpha could perform all the control functions by means of a code; for example, a certain number of bursts of certain durations could trigger mixtures of channels.

I have not pursued further development of brainwaves as a musical resource in order to let myself move on to other works involving other ideas including echolocation, underwater sound, resonant characteristics of rooms and the alteration of vocal identities. I am happy to see that many other composers are using alpha in creative and imaginative ways.

Music for Solo Performer is dedicated to John Cage who assisted me in the first performance on May 5, 1965 at the Rose Art Museum, Brandeis University and to whom I am grateful for encouragement greatly appreciated at that time as well as now.

The Electronic Cafe International, founded in the Orwellian year of 1984, is the mother of all cybercafes, a unique international network of multimedia telecommunications venues with over 40 affiliates around the globe. The ECI Network organizes and produces live performances and encounters in "virtual space." Most ECI performances and activities incorporate the visions of several geographically dispersed collaborators, and occur in more than one place at the same time: video technology links performers who perform simultaneously in various locations around the world. Patrons around the world participate in interactive events. Ambient music is created by DJ's in several cities at once while audiences in different cities dance together in the same live projected image-space. Analog telephone lines, digital ISDN lines, and Internet

networking capabilities are often used in concert to create a hybrid multimedia network not available from any one service provider, thus enabling us to model emerging telecom environments years before they are alleged to arrive in our homes. Many of the ECI events and activities are cybercast on the Internet via CU-SeeMe using ISDN connections to the net.

Users and collaborators range from computer and industry professionals, educators, students, world class artists, children, and the general public interested in participating in and modeling what would be essential in regards to a multimedia information and telecommunications environment that is not dysfunctional or overtly discriminating.

ECI has a network of official venues all over the world including New York City; Paris; Palo Alto; Copenhagen; Toronto; and Santa Monica, CA. New ECIs are being established in Austin, Texas; Woodstock, New York; Boston, Mass.; Las Vegas, Nevada; Tokyo; Moscow; Jerusalem; Madrid; London; and major cities in Italy; Chile; and Ireland. There are also over 40 Affiliates ECIs around the world and growing including Vancouver, Canada; Grahamstown, South Africa; Managua, Nicaragua; Linz, Austria; Rio; and Havana, Cuba. Each month more and more requests are received by people wanting to open an ECI or become a part of the growing ECI Affiliate Network.

Kit Galloway and Sherrie Rabinowitz are the co-founders of Electronic Cafe International. ECI has established a research lab at Viacom International to model human-to-human multimedia telecommunications and constituency building in environments for emerging interactive TV environments. ECI is also collaborating with Interval Research, a Palo Alto think tank and R&D company researching and prototyping the technology for the next paradigm in virtual communities. Additionally, Galloway and Rabinowitz were awarded the PACE Award for "Ten Years of Leadership in the Field of Teleconferencing" given by Telespan, a leading teleconferencing industry newsletter.

On Being Invisible II (Hypatia Speaks to Jefferson in a Dream) [David Rosenboom] is a Self Organizing, Multi-Media Performance Work Utilizing Event-Related Potentials From Performers' Brains (1994-95).

In the late 1960's I became fascinated with new developments in brain science as they related to musical perception and the emergence of new musical languages. Ideas from cybernetics, notably those relating to the self-regulation of systems by means of feedback, were finding their way into psycho-biological research, resulting in an explosion of interest in something popularly known as, *biofeedback*. The notion of self-regulation, that individuals may be able to achieve a degree of conscious, willful control of particular body functions formerly thought only to be regulated by unconscious, autonomic processes, captured the imaginations of many people. My own interest in biofeedback centered around the notion that self-regulation of brain functions, as could be observed through monitoring aspects of electrical brain activity, was closely related to certain processes involved in the evolution of new musical styles.

Self-regulation by means of feedback is also closely related to some ideas about evolution, and models of evolution appear as a consistent, thematic referent throughout much of my musical work. Consequently, I began a long period of research in information processing modalities of the nervous system as they relate to aesthetic experience and creative activity. I produced many musical compositions and interdisciplinary, artistic pieces in which the material forms in the works were generated spontaneously by means of direct monitoring of electrical brain activity and/or other body functions. I published numerous articles about this work, two books, *Biofeedback and the Arts and Extended Musical Interface with the Human Nervous System*, and several recordings. This was, however, only a beginning.

In 1976, I began creating a work entitled *On Being Invisible*, which, for me, contains the richest aesthetic, symbolic and metaphorical content arising from the import that biofeedback systems had on my work as a composer. *On Being Invisible* is a self-organizing, dynamical system, rather than a fixed musical composition. The title refers to the role of the individual within an evolving, dynamical environment, who makes decisions concerning when and how to be a conscious *initiator* of action and when simply to allow her or his individual, internal dynamics to co-evolve within the macroscopic dynamics of the system as a whole. Consequently, the work is always ongoing. Within the corpus of my music, the title serves as a label for a period of work with these ideas from about 1976 to 1979. A recording of an early version was released in 1977. Recently, after concentrating on other things for several years, I have begun new work with this system, calling it, *On Being Invisible II*. This new work is stimulated partly by advances in technology that only now make the realization of earlier concepts possible, and it is partly the result of interest in applying new knowledge within a still very rich musical paradigm.

One of the primary objectives in this research was to achieve the technical capability necessary to create an *attention-dependent sonic environment*. I wanted to create a situation in which the syntax of a sonic language orders itself according to the manner in which sound is perceived. To accomplish this, components of the electroencephalogram (EEG) recorded from the brains of on-stage performers, known as *event-related potentials (ERP's)*, are detected, measured and analyzed. ERP's are transient waveforms in the EEG associated with the occurrence of stimulus events having a high degree of salience — particular meaningfulness — to the subject emitting these brainwaves, always in relation to a particular context of surrounding events. Next, computers are programmed to produce a stream of sonic events according to some predetermined starting point or compositional method devised by the composer. The computer software also contains a partial model of musical perception, with which it attempts to predict what events in its own, musical output might be perceived by the subject as having significance in the emerging musical structure. Usually, these correspond to boundary points, such as the end of a phrase and the beginning of a new phrase, a significant change in texture, or

changes in the pattern grouping of phrases into sequences or other higher level forms. A powerful, widely-used software tool which I co-authored, known as HMSL, (*Hierarchical Music Specification Language*), is used to manipulate formal musical elements referred to as *morphologies*, or *morphs*, for short. ERP's from the performer-subjects are then analyzed to determine if the computer's predictions correspond to signals from the brain that should accompany important, attention-securing events. If they do not, the generating algorithms allow the music to mutate into new forms and new predictions are tested. If the predictions are confirmed, the kinds of events reliably associated with these confirmed predictions gain prominence in the musical fabric. In this way, self-organizing, musical forms can emerge that are related to the shifts of attention experienced by the performer-subjects and that can be confirmed by brain signal measurements. In modern terminology, this system exhibits many of the characteristics of what we call, *complex adaptive systems*. Such systems are used to model the evolution of complex life forms that are often governed by simple, underlying rules. Thus, an interactive, musical system is produced that can spontaneously evolve new, emerging, musical orderings, and perhaps, even languages.

Over many years of performing, writing, producing recordings of *brainwave music*, and further thinking, the components of this feedback system began to remind me of characters in a mythological drama, the spontaneous forces of creativity, the drive to converge upon ordered relationships in society, the counterbalancing tension of divergence from order as our consciousness loses its focus on orderings from the past, and the fundamental uncertainties regarding forces in nature that are only partially knowable. Consequently, I began to think about *On Being Invisible* in theatrical or narrative terms. This raised an important question. If music combined with theater can be loosely termed, *opera*, how, then, does one go about creating a *self-organizing opera*? This question may never be fully answered, but it is far too stimulating to my imagination to stop trying.

On Being Invisible II (Hypatia Speaks to Jefferson in a Dream) is an experiment with this question. The setting is a dream in which Thomas Jefferson hears the voice of the Greek, woman, astronomer, mathematician, and philosopher, Hypatia, traversing the centuries of time and the space of continents, mingling with his own internal voices as he is writing one of his later-to-be-famous documents. The components of ideological conflict that emerge from this scene remind me of the tension associated with the individual performer in *On Being Invisible*, who must always negotiate a thin dividing line separating being part of something larger than one's self and trying to willfully direct a naturally evolving process. Hypatia, an Alexandrian who was murdered in A.D. 415 for being both Greek and a woman who dared to lecture, resided at a focal point of change in the old world, the end of Classical Greek philosophy and the beginning of the Dark Ages, the foundation of Neo-Platonism and the emergence of Plotinus, the transformation of Christianity from a moral teaching into a brutal instrument of political power, the appropriation of Plotinus and mysticism by the Christians to obscure thought and

achieve totalitarian, political control, the decline of Alexandria as an intellectual center, symbolized by the destruction of the fabled library, combined with an unprecedented outpouring of romantic, multi-sexual poetry, and the labyrinthine racial-political conflicts there among Greeks, Jews, Ptolemaics, remnants of Egyptian antiquity, Copts, Islamics, Europeans, and numerous others. These are just a small sampling. Similarly, Thomas Jefferson was a figure wedged in-between the end of the Age of Enlightenment and emerging Romanticism, an American hero who espoused freedom of thought and religion but also kept slaves, a revolutionary torn between rationality and romance, who's relationships with women, from slaves to European intellectuals, symbolized the psycho-sexual dilemma of a young nation, whose brilliant inventiveness and creative genius was at once steeped in Neo-Classicism and evinced a great contempt for Plato, who was both a champion of the political avant garde and a player in the new dynamics of wealth and power, a president in the new world who was also obsessed with the mathematics of miscegenation. The *invisibility* manifest in this scenario is represented by the dream state of Jefferson in which these conflicts energize his thoughts and entreaties to wisdom are transmitted to him through warps in space-time by the reincarnated mind of Hypatia.

This realization of *On Being Invisible II* is set for two performers, representing Hypatia and Jefferson, whose brain signals are being monitored and event-related potentials analyzed. The results are used to create the forms of electronic music we hear, sequences of visual icons we see through computerized video projection, and arrangements of words spoken by electronically sampled voices. The words come from various texts by Jefferson, including selections from his letters and writings on the arts and philosophy. Hypatia's words are speculative. They come from modern authors, original words by the composer, and selections from Hypatia's contemporaries. Each of these characters has a double image on stage in the form of a musician. These are the ghost doubles of Hypatia and Jefferson, in the sense of being their personal angels and also representing human beings' propensity to make copies of themselves in nefarious forms. These musical parts are written for master improvisers to provide musical glue for the performance. Finally, a narrator represents the dream state and a neutral form of the emerging properties of a new, global consciousness. DR 1995

Credits and Acknowledgments

Conception and Composition: David Rosenboom, 1994 - 95, based on the earlier work, *On Being Invisible*, (an attention-dependent sonic environment), 1976 - 1979. Technical assistance and computer/video image design: Kent Clelland. Recorded Voices: Teri DeSario and Roxanne Merryfield. Projected Slide Collages: Jacqueline Humbert. Digital video assistance: Warren Heaton. Photoshop computer assistance: Vincent Carté. Analog video assistance: Steven Kury. Media consultant: Sara Roberts. Brain science inspiration: Dr. E.E. "Ted" Coons and Dr. Lloyd Kaufman.

The Angel Concerto [Morton Subotnick] is an excerpt from a work in progress, *An Intimate Immensity, a TeleOpera*.

The following is a rough description of *An Intimate Immensity*, which is expected to be ready for a first complete performance in the spring of 1997.

An Intimate Immensity is a dramatic interaction between the activities being witnessed in three auditoriums (in three cities) simultaneously.

The audience in each city will primarily experience the drama which is taking place 'live' in their auditorium, but they will experience the activities of each of the other auditoriums through monitors and/or projections.

There are four characters: Character 1 is a male poet-philosopher [actor/singer]. He is on one coast of the U.S. Character 2 is a female hacker/cyber-activist [actress/singer]. She is on the other coast. Characters 3 & 4 are 'cyber-angels'. They are musicians/actors and are located together somewhere in the middle of the country (probably Santa Fe or Phoenix).

He (the poet) is creating a work entitled "Intimate Immensity: The Poetics of Cyberspace". Cyberspace, to him, is a utopian metaphor for the internal space of the mind, a personal and boundless space. He sees this as the ultimate liberation, one in which individuals are finally empowered. She (the hacker-activist) has a very different opinion of the cyberspace. She sends warning messages out to cyberspace and rewrites and resends existing literature.

As the opera opens we find her at her 'hacking'. She is attempting to create virtual automobiles as a result of the recent bar coding of all vehicles in the U.S. While she is working she sees the poet's work begin to appear on her monitor, and stops work on the virtual auto project, and begins to hack at his book. They become aware of each others work, she by seeing/hearing his work, and him by seeing the distortion and/or disturbance caused by her on his work. The culmination of the opera is a dialectical battle between the two. Her disturbances to his creation and his recreating his thoughts take place as an interactive dialog which ultimately create a definition of the cyberspace, a definition which portrays the cyberspace as being in perpetual change.

The third and fourth characters are a pair of 'cyber-angels' who create an opera like setting for everyone who enters the cyberspace. This is an extension of what media (CNN) does now, i.e. dramatizing: the Gulf War, OJ, Oklahoma City, etc. That is, creating image and music to give a dramatic color to the real events of our time.

At the time of this opera, every person has a computer net in his/her home and/or office with a computer controlled musical instrument (the disclavier piano), computer controlled lights, and the backdrop for projections (laser images). Whenever an individual enters the net, the cyber-angels (who have a duplicate of every space) create background music, theatrical lighting, and images for whatever seems to be the mindset and situation of the individual.

The music performed tonight is the overture for the female activist. This overture (which will in its final form be accompanied by computer imagery) is experienced by her each time she logs on. It is

her personal dramatic theme music created and performed live by her cyber-angel who exists somewhere in cyberspace.

Binary Aria [Mark Coniglio, Dawn Stopellio] is the opening episode from **The Electronic Disturbance**, an evening length work currently being developed by Troika Ranch.

The Electronic Disturbance will explore the growing conflict between the two bodies that we each possess: the fleshy, corporeal body and its ethereal, electronic counterpart, a presence found in corporate and government databanks and on communications networks like the internet. The work is set at a crucial moment in future time when each form (electronic and corporeal) desires to appropriate the basic characteristics of the other, the corporeal bodies struggling to discard their weak flesh and the physical laws of gravity and time while the electronic forms simultaneously attempt to enter the physical world. The premiere of *The Electronic Disturbance* is scheduled for May of 1996.

We would like to dedicate this performance to the memory of Rebecca Bobele, whose creativity and boundless energy will always remain an inspiration to us.

Biographies

Alvin Lucier was born in 1931 in Nashua, New Hampshire. He was educated in Nashua parochial and public schools, The Portsmouth Abbey School, Yale and Brandeis, and spent two years in Rome on a Fulbright Scholarship. From 1962 to 1969 he taught at Brandeis where he conducted the Brandeis University Chamber Chorus which devoted much of its time to the performance of new music. In 1966 he cofounded the Sonic Arts Union with composer Robert Ashley, David Behrman and Gordon Mumma, and from 1972 to 1979 was music director of the Viola Farber Dance Company. Since 1970 he has taught at Wesleyan University where he is currently John Spencer Camp Professor of Music.

Lucier performs and lectures extensively throughout the United States and Europe. In 1984, he made a three-month concert and lecture tour of Hawaii, New Zealand, Australia and Indonesia, and in the spring of 1985 he participated in a major retrospective of his works in Holland, consisting of installations, concerts and lectures in several cities including Amsterdam, Eindhoven and Otterlo, as well as an all-day radio broadcast on VPRO in Hilversum. In 1987-1988 he toured Europe, appearing at the ISCM Festival in Frankfurt, the Numus Festival in Aarhus, Denmark, and the Rhine Festival in Dusseldorf, as well as solo performances in Cologne, Zurich and Berlin. In the Fall of 1989 Mr. Lucier made a two-week tour of Japan.

Lucier has contributed many articles to books and periodicals, including Individuals: Post-Movement Art, edited by Alan Sondheim, E.P. Dutton; Crisscross: The Musical Quarterly; Parachute: Performance: Sonus, and Contiguous Lines: Issues and Ideas in the Music of the 60's and 70's, edited by Thomas DeLeo, University Press of America. His own book, Chambers, written in collaboration with Douglas Simon, was published by the Wesleyan University Press and is distributed by Harper and Row. In addition, several of his works are available on Cramps (Italy), Disques Montaigne, Elektra/Nonesuch, Source, Mainstream, CBS Odyssey, and Lovely Music Records.

Alvin Lucier has pioneered in many areas of music composition and performance, including the notation of performers' physical gestures, the use of brain waves in live performance, the generation of visual imagery by sound in vibrating media, and the evocation of room acoustics for musical purposes. His recent works include a series of sound installations and works for solo instruments, chamber ensembles, and orchestra in which, by means of close tunings with pure tones, sound waves are caused to spin through space.

Lucier's sound installations include *Seesaw*, first exhibited at the Whitney Museum of American Art in New York, during the Winter of 1983-1984; *Spinner*, commissioned by Real Art Ways for permanent placement in Hartford, Connecticut; and *Sound On Paper*, part of The Writing on the Wall show at the Islip Art Museum, East Islip, New York, during the Fall of 1985. In the Fall of 1988, Wesleyan University presented a retrospective of several of his sound

installations, including *Chambers*, *Music On A Long Thin Wire*, and *Music For Pure Waves*, *Bass Drums*, and *Acoustic Pendulums*.

Since 1982 Alvin Lucier has been devoting much of his time to composing works for traditional Western musical instruments. His orchestral work, *Crossings*, first performed by members of the Chicago Symphony Orchestra on the New Music America Festival '82 in Chicago, was given its New York premier by the Brooklyn Philharmonic in January, 1984; his *Serenade For Thirteen Winds And Pure Wave Oscillators*, commissioned by the Fromm Music Foundation, was first performed at the Aspen Music Festival in August, 1985, and his *Septet For Three Winds, Four Strings And Pure Wave Oscillator* was composed for and performed on the inaugural concert of the New World Consort at Wesleyan University on September 20, 1985.

During the past several years Lucier has composed a series of works, including *Homage to James Tenney* for solo double bass, written especially for the *Tribute to James Tenney* issue of *Perspectives of New Music*, Volume 25, Nos. 1&2, Winter 1987, Summer 1987; *Kettles* for five timpani and pure wave oscillators, premiered at the New Music America Festival, in Philadelphia, in October, 1987; and *Fideliotrio*, for viola cello and piano, commissioned by the Fedilio Trio and first performed by them on January 3rd, 1988, at the Old State House, Hartford. More recently he finished *Silver Streetcar For The Orchestra*, a solo work for triangle, premiered by percussionist Brian Johnson on December 8, 1988, at New Music America Miami, and *Carbon Copies*, a trio commissioned by Challenge (saxophonist Anthony Braxton, pianist David Rosenboom and percussionist William Winart), premiered at the trio's inaugural concert on April 1, 1989, at Mills College, Oakland, California.

More recently Lucier wrote *Clackers and Swoopers*, an outdoor work for sirens and blocks of wood (1989), for the inauguration of William Chance, President of Wesleyan University, and *Music For Snare Drum, Pure Wave Oscillator and One or More Reflective Surfaces* for the Noble Snare Company. He recently completed *Music for Piano and Amplified Sonorous Vessels* for Pianist Margaret Leng Tan and *Nothing Is Real*, an arrangement of a Beatles song for Aki Takahashi, commissioned by the Toshiba-EMI Record Company, Japan. A recent work, *Navigations for Strings*, was commissioned by the Hessischer Rundfunk, for the Arditti Quartet. It received its first performance on October 11, 1991, in Frankfurt.

Lucier has collaborated with choreographer Douglas Dunn and sculptor David Ireland on *Dances for Men, Women, and Moving Door*, a full length stage work presented in New York in June, 1986, and supplied music for *Volcano Saga*, a theatre piece by Joan Jonas which was performed at Real Art Ways in Hartford in September of that year.

Mr. Lucier has received commissions from the Jack E. Lund Foundation at Tanglewood; The Harvard Music Foundation; the Merce Cunningham, Douglas Dunn and Viola Farber Dance Companies; the New Music Ensemble, Providence, Rhode Island; the State University College of New York, Potsdam, New York; the

Fort Worth Art Museum, and the Farmers and Mechanics Bank, Middletown, Connecticut. He has also received grants from the New York State Council on the Arts; the Rockefeller Foundation; the Connecticut Council on the Arts, and three Composers Fellowship Grants from the National Endowment for the Arts. He is currently on the Board of Directors of Real Art Ways in Hartford, Connecticut, and the Board of Advisors of Composers Forum and the Fromm Music Foundation.

Alvin Lucier resided in Berlin for six months during the fall and winter of 1990-91, as a guest of the DAAD Kunstler Program. In January 1992, he performed in Dehli, Madras, and Bombay, and during the summer of that year was guest composer at the Time of Music Festival in Vitaasari, Finland. In October, 1992, Mr. Lucier made a two-week tour of Japan with pianist Aki Takahashi, for whom he wrote a new work, *Music For Piano With Slow Sweep, Pure Wave Oscillators*.

In October, 1994, Wesleyan University honored Lucier with a five-day festival, Alvin Lucier: Collaborations, for which he composed twelve new works, including *Theme*, based on a poem by John Ashbery and *Skin, Meat, Bone*, a collaborative theater work with Robert Wilson.

In March 1995, *Reflections/Reflexionen*, a bi-lingual edition of Lucier's scores, interviews and writings was published by MusikTexte, Klon.

Alvin Lucier lives in Middletown, Connecticut, with his wife, Wendy Wallbank Stokes, and daughter, Amanda Stokes Lucier.

David Rosenboom (b. 1947) has been widely acclaimed as a pioneer in American experimental music since the 1960's. He is a composer, performer, author, educator, researcher and interdisciplinary artist. He has composed for instruments and technological media, is a conductor, pianist, master improviser, performance artist, violinist, violist, percussionist, performance artist and has worked extensively in computer music and integrated media, emphasizing live performance.

Prior to assuming his current positions in 1990 as Dean of the School of Music, Co-director of the Center for Experiments in Art, Information and Technology and Conductor of the New Century Players at the California Institute of the Arts, Rosenboom was the Darius Milhaud Professor of Music at Mills College, where he was also Head of the Music Department and Director of the Center for Contemporary Music during the 1980's. He taught interdisciplinary subjects at the San Francisco Art Institute and the California College of Arts and Crafts and has been a guest faculty member at many institutions, including the University of Illinois, where he was appointed George A. Miller Professor in 1995, the Banff Centre for the Arts, and Simon Fraser University. In the 1970's he was a Professor and founder of the Department of Music and Interdisciplinary Graduate Studies Programme at York University in Toronto. He taught music and fine arts courses there, directed performing groups, was Coordinator of Interdisciplinary Studies in the Faculty of Fine Arts, and founder and Director of the Electronic

Media Studios and Laboratory of Experimental Aesthetics. In the 1960's he was a Creative Associate in the Center for Creative and Performing Arts at the State University of NY in Buffalo, Artistic Coordinator of New York's Electric Circus, Co-founder of a research and development company in the electronic arts (Neurona Co.), worked in commercial broadcast media, and was an active, independent performer, composer and producer. Prior to that, he studied at the University of Illinois with such composers and musicians as Salvatore Martirano, Lejaren Hiller, Kenneth Gaburo, Gordon Binkerd, Bernard Goodman, Paul Roland, Jack McKenzie, Soulima Stravinsky, and John Garvey, and engaged in special studies in physics, computer science, experimental psychology and multi-media there, at New York University and independently. He has a particular interest in interdisciplinary work, combining the arts, sciences and humanities. He has served as an advisor, board member and professional affiliate with national arts organizations in the U.S. and Canada, has consulted to industry, operated several independent music and arts publishing and recording organizations and worked in television, film and video.

He has organized numerous performing groups, including the performance art group, *Maple Sugar*, in Toronto (with Manupelli and Humbert) and the open instrumental ensemble, *Challenge*, in Oakland (with Braxton and Winant), and has collaborated with many leading composers and musicians of our time. His own work has been presented extensively in Europe, North and South America and in Japan. He is a conductor emphasizing 20th Century literature and has collaborated extensively with non-Western musicians. He has developed computer software for music, was co-designer of a computerized keyboard instrument with Donald Buchla, the *Touché*, and is co-author of *HMSL (Hierarchical Music Specification Language)*, a music programming language widely used by educational institutions and individuals around the world.

Rosenboom has conducted extensive research into information processing modes of the brain as they relate to aesthetic experience and has published two books on the subject, *Biofeedback and the Arts*, and *Extended Musical Interface with the Human Nervous System*. Two of his well-known recordings, *Brainwave Music* and *On Being Invisible*, feature the musical results of this work. His work is regularly disseminated through publications in books and professional journals, such as *Perspectives in New Music*, Leonardo, *Musicworks*, *Computer Music Journal*, *Performing Arts Journal* and others. He has received awards and commissions and has carried out research and creative projects with support from agencies like the National Endowment for the Arts, National Science Foundation, Canada Council, the Mellon and Irvine Foundations, York University, Mills College, the AT&T Foundation, the Norton Family Foundation, Yamaha Corporation of America, the Inter-University Consortium for Educational Computing and others.

Some of Rosenboom's other well-known recorded works include, *Future Travel* (computer and acoustic instruments), *Roundup* (an anthology of live electro-acoustic works), *Suitable for Framing* (two pianos and South Indian Mrdangam), *And Out Come the Night Ears*

(piano and electronics), *Systems of Judgment* (computer music systems and various instruments), and *How Much Better If Plymouth Rock Had Landed On The Pilgrims, In The Beginning* (a series of nine works), *A Precipice In Time*, and *Two Lines*, all for various ensembles.

Morton Subotnick is one of the United States' premier composers of electronic music and an innovator in works involving instruments and other media, including interactive computer music systems. Most of his music calls for a computer part, or live electronic processing; his oeuvre utilizes many of the important technological breakthroughs in the history of the genre.

The work which brought Subotnick celebrity was *Silver Apples of the Moon*. Written in 1967 using the Buchla modular synthesizer (an electronic instrument built by Donald Buchla utilizing suggestions from Subotnick and Ramon Sender), this work contains synthesized tone colours striking for its day, and a control over pitch that many other contemporary electronic composers had relinquished. There is a rich counterpoint of gestures, in marked contrast to the simple surfaces of much contemporary electronic music. There are sections marked by very clear pulses, another unusual trait for its time; *Silver Apples of the Moon* was commissioned by Nonesuch Records, marking the first time an original large-scale composition had been created specifically for the disc medium - a conscious acknowledgment that the home stereo system constituted a present-day form of chamber music. Subotnick wrote this piece (and subsequent record company commissions) in two parts to correspond to the two sides of an LP. The exciting, exotic timbres and the dance-inspiring rhythms caught the ear of the public -- the record was an American bestseller in the classical music category, an extremely unusual occurrence for any contemporary concert music at this time. It is scheduled for rerelease in 1993 on Wergo cd with *The Wild Bull*.

The next eight years saw the production of several more important compositions for LP, realized on the Buchla synthesizer: *The Wild Bull*, *Touch*, *Sidewinder* and *Four Butterflies*. All of these pieces are marked by sophisticated timbres, contrapuntally rich textures, and sections of continuous pulse suggesting dance. In fact, *Silver Apples of the Moon* was used as dance music by several companies including the Stuttgart Ballet and Ballet Rambert and *The Wild Bull*, *A Sky of Cloudless Sulphur* and *The Key to Songs*, have been choreographed by leading dance companies throughout the world.

In 1975, fulfilling another record company commission, (this time, *Odyssey*) Subotnick composed *Until Spring*, a work for solo synthesizer. In this work, changes in settings which Subotnick made in real time on the synthesizer were stored as control voltages on a separate tape, enabling him to duplicate any of his performance controls, and to subsequently modify them if he felt the desire to do so. While the use of control voltages was nothing new, it suggested to Subotnick a means to gain exact control over real-time electronic processing equipment.

The next step in Subotnick's use of control voltages was the development of the "ghost" box. This is a fairly simple electronic device, consisting of a pitch and envelope follower for a live signal, and the following voltage controlled units: an amplifier, a frequency shifter, and a ring modulator. The control voltages for the ghost box were originally stored on a tape, updated now to E-PROM. A performer, whose mixed signal is sent into the ghost box, can then be processed by playing back the pre-recorded tape or E-PROM, containing the control voltages. As neither the tape nor E-PROM produce sound, Subotnick refers to their sound modification as a "ghost score". By providing the performer with exact timings, coordination between performer and the ghost score is controlled.

Two Life Histories (1977) was the first piece involving an electronic ghost score; the bulk of Subotnick's output for the next six years was devoted to compositions involving performers and ghost scores. Some of the more notable works in this series include *Liquid Strata* (piano), *Parallel Lines* (piccolo accompanied by nine players), *The Wild Beasts* (trombone and piano), *Axolotl* (solo cello), *The Last Dream of the Beast* (solo voice) and *The Fluttering of Wings* (string quartet). The subtlety, sophistication and control over real-time electronic processing that Subotnick demonstrated in these innovative works secured his reputation as one of the world's most important electronic music composers.

Subotnick reached the apex of live electronic processing in his work *Ascent Into Air* (1981). Written for the powerful 4C computer at IRCAM, this piece involved many of the techniques which Subotnick had developed in his ghost scores. In addition to the processing normally available to him with his ghost boxes, Subotnick was able to spatially locate sounds in a quadruphonic field and to modulate the timbres of the instruments. But perhaps the most significant aspect of this work is its use of live performers to control the computer music; the live performers, in effect, serve as "control voltages" to influence where a sound is placed, how it is modulated and by how much, etc. -- the reverse situation of the ghost score compositions. Even more remarkable is the ability of traditional musical instruments to control computer-generated sounds. The sophistication of this control is currently unavailable using the commercial MIDI devices which many electronic musicians, including Subotnick, favor today.

Since 1985, Subotnick has been using commercially available MIDI gear in works such as *The Key to Songs*, *Return* and "all my hummingbirds have alibis". His more recent pieces are also marked not only by pulse-driven rhythms, but also by clear diatonic melodies and harmonies.

In addition to music in the electronic medium, Subotnick has written for symphony orchestra, chamber ensembles, theater and multimedia productions. His "staged tone poem" *The Double Life of Amphibians*, a collaboration with director Lee Breuer and visual artist Irving Petlin, utilizing live interaction between singers, instrumentalists and computer, was premiered at the 1984 Olympic Arts Festival in Los Angeles.

The concert version of *Jacob's Room*, a monodrama commissioned by Betty Freeman for the Kronos Quartet and singer Joan La Barbara,

received its premiere in San Francisco in 1985. *Jacob's Room*, Subotnick's multimedia opera (directed by Herbert Blau with video imagery by Steina and Woody Vasulka, featuring Joan La Barbara), received its premiere in Philadelphia in April 1993 under the auspices of The American Music Theater Festival. *The Key to Songs*, for chamber orchestra and computer, was premiered at the 1985 Aspen Music Festival. *Return*, commissioned to celebrate the return of Halley's Comet, premiered with an accompanying sky show in the Planetarium of Griffith Observatory in Los Angeles in 1986.

Subotnick's recent works -- among them *Jacob's Room*, *The Key to Songs*, *Hungers*, *In Two Worlds*, *And the Butterflies Begin to Sing*, and *A Desert Flowers* -- utilize computerized sound generation, specially designed software *Interactor* and "intelligent" computer controls which allow the performers to interact with the computer technology.

Currently, Subotnick co-directs both the Composition program and the Center for Experiments in Art, Information and Technology (CEAIT) at the California Institute of the Arts. He tours extensively throughout the U.S. and Europe as a lecturer and composer/performer. He is published by European-American.

Troika Ranch is a performance group committed to developing new works of the *slash arts*: music / dance / theater / media. The key to the slash arts is the slash itself, the linkage of varied forms of expression into a unified whole. This effort often includes the use of emerging technologies to allow the performer's movements and vocalizations to control sound, light and image from within the performance.

Troika Ranch was co-founded by composer Mark Coniglio and choreographer Dawn Stoppiello in Los Angeles in 1993. They relocated to New York City in November of 1994. Since arriving, they have added three new performers, Lana Halvorsen, Rose Marie Hegenbart, and Artemis Preeshi, who have played an instrumental role in the development of this new work. *Troika Ranch* will be performing on May 19 & 20 at the Gowanus Arts Exchange in Brooklyn as a part of the Outback Series and again in October in Manhattan for the New Dance Alliances' Performance Mix.

Susan Allen, harp, electric harp, kayagum, CalArts New Century Players, and Associate Dean at CalArts, has premiered numerous works in Europe, Canada, South America, Australia and the U.S. including performances on NBC's Today Show and on National Public Radio.

Jacqueline Bobak, soprano, performs a repertoire ranging from opera to chamber music, from the traditional to the avant-garde. In 1991, she joined the faculty at CalArts, where she teaches courses in voice.

Nicholas England, music history, is a pianist, harpist, and a noted ethnomusicologist and Africanist, as well as being the international authority on music of the Khoisan. He is currently

Director of the Intercultural Arts Project and a member of the faculty at CalArts.

Erika Duke-Kirkpatrick, cellist, CalArts New Century Players, is an active soloist, chamber musician, and specialist in contemporary music. She is a member of the performance faculty at CalArts.

Laura Kuennen-Poper, viola, CalArts New Century Players, is currently a member of the Los Angeles Chamber Orchestra. She is a member of the performance faculty at CalArts.

Vicki Ray, pianist, is currently a member of the Los Angeles new music ensemble XTET and the Southwest Chamber Music Society. She is a member of the performance faculty at CalArts.

Wadada Leo Smith, trumpet, multi-instrumentalist, composer and improviser has been active in creative contemporary world music for over thirty years. He is a faculty member at CalArts, and is also the first holder of the Dizzy Gillespie Chair.

Sara Roberts, New Media, is a founding member of Techné, a group of artists working with ubiquitous interactivity. In 1993 she was a resident at the Djerassi Foundation and her interactive sculpture, Digital Museum, was commissioned by Silicon Graphics for the Interactive Gallery at the Seybold conference in San Francisco. She is a member of the faculty at CalArts.

Daniel Rothman, composer, is a member of the composition faculty at California Institute of the Arts.

Kent Clelland, is an MFA candidate in the School of Music at CalArts, and is studying composition for interactive media technologies. His recent works include an electronic opera entitled "Sensitive Dependence", and several scores for experimental computer animations.

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